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ELECTRICAL OPERATION OF GATE VALVES[1]

By Peter Payne Dean[2]

The art of power operation of gate valves has probably been given less thought than any other power operated device, not only in water works, but also in steam practice.

Up to five years ago the electrically operated valve was almost a thing of the past, its development having entirely stopped in favor of cylinder operation, but since that time it has again come to life and is now making rapid strides, threatening seriously to eliminate cylinder operation for almost every use, and entirely, where distant control is required.

A large gate-valve, after having been installed for some years and without much care, becomes exceedingly hard to operate and sometimes requires the efforts of six or eight men to close. Being difficult, and requiring so much physical effort, it is consequently avoided and gradually gets in worse condition, so that when it is required in an emergency, it usually fails to function. Valves of this type are always a source of worry to the waterworks superintendent.

Shut-offs take considerable time and in the event of a break much damage may be done by an uninterrupted flow. To be able to close a pair of 36 or 48 inch gate valves, in say 10 or 12 minutes, with only one operating man, would at least save a bad wash-out and considerable property damage.

Standpipe valves, to operate from a remote point, are also of importance, as by certain operation high pressure may be pumped directly into the mains.

Pump discharge valves are very frequently electrically operated, allowing different pumps to be put into service very quickly.

With electrically operated pumps of the centrifugal type the failure of the check to close, when the pump is shut down, would probably cause considerable damage, and by applying electrical operation to the discharge valve next to the check the pump and motor may be afforded additional protection.

[1] Presented before the Cleveland Convention, June 7, 1921.

[2] Payne Dean Limited, New York, N. Y.

Breaking of mains is undoubtedly the most important consideration for electrically operated valves and by choosing a combination system of electric control for the most important valve and a portable automobile type of control for outlying district and smaller valves, a shut-off may be effectively made.

We have certain extremely congested business centers in our large cities that would suffer untold loss and inconvenience if badly flooded. Public buildings, such as art museums and libraries, housing some of the most valuable works of art in the world, would be seriously threatened if large volumes of water were to get at their foundations. Underground railways usually suffer most from this kind of flood, as they are below the street level and while the third rail is submerged, the system is out of commission.

These and hundreds of other reasons for flood protection should receive serious consideration from municipal authorities. Strange to say, however, they admit the seriousness of the situation and yet do not seem to exert much of an effort toward finding a remedy. One reason, perhaps, is the lack of information on power operating devices for attachment to existing valves, and then again the valve manufacturers have never actively pushed any form of mechanically operated valve.

The superintendent is thus left to his own resources and knowing the conditions under which such valves are expected to operate, perhaps does not believe that there is anything available to do the work.

A few well-placed electrically operated control valves would afford, no doubt, ample protection to a congested district. But, of course, the number would have to be limited on account of the expense. Since I have never yet found any water works man to argue against power operation of valves, but on the contrary readily admit their value, I would like to explain here, why in my opinion, electrical operation is the only system that fulfills all the conditions.

Electricity is now available at practically every point and is the most reliable power known. The electric motor has so advanced in construction and design as to be adaptable to any and every possible use. It can be made water-tight and to work submerged, or in the open, exposed to snow and ice (merchants). The apparatus is ruggedly constructed and foolproof and can be placed at remote points.

Conducting cable is now made with a lead and steel covering, suitable for laying in an open trench or being submerged without additional protection. Indication of the position of the valve gate may also be shown at any distant point by the aid of a few wires.

Last, but by no means, least, an electrical unit may be attached to the valve without in any way disturbing it and without shutting off the supplies, which is the most important consideration.

Operation of large gate valves in street vaults usually presents the greatest difficulty, for these reasons:

The valve may be very old and exceedingly hard to operate.

It must be closed under a velocity in the line due to a break.

The control unit must be of such size as to pass through the ordinary man-hole.

The unit must be absolutely water- and damp-proof and stand partial submergence, caused by volumes of water passing through the man-hole covers.

It must be constructed to be left inoperative for long periods but always ready to operate in case of emergency.

It must not be affected by extreme cold, must be self-lubricating and must have a positive stop at both ends of the gate travel to prevent jamming.

Such operating conditions call for an entirely special device and the Dean Control was designed with entire regard for operating under such conditions.

The Dean System of Valve Control, which is the outcome of these observations, is built on somewhat radical lines with five particular features incorporated, namely:

1. A single unit system
2. Can be attached to existing valves with a minimum of effort and without shutting down the line
3. Is positive in operation and does not depend upon momentum or drift of moving parts to seat
4. Has ample unseating and seating torque
5. The whole unit is enclosed and waterproof.

The system consists of a single unit in which is incorporated the driving motor, reduction gears, and limit trip mechanism. The feet of the unit are provided with four holding down bolt holes of standard dimensions for a given range of valves. Four standard units cover the complete line of valve sizes in use.

The motor is totally enclosed and waterproof and possesses an extremely high torque. It is connected to a system of combination worm and planetary gearing for the necessary reduction in speed. The motor speed is normally 1600 r.p.m. and the slow speed shaft 40 r.p.m., the gear reduction being 40 to 1.

The motor shaft is coupled to the worm shaft, both running on ball bearings, and the worm wheel is keyed on to a sleeve forming the sun pinion of a planetary gear. The planet pinions revolve on large studs forced into a flange on the slow speed driving shaft and these pinions mesh into the internal gear forming the outer member of the planetary.

The system is built for either alternating or direct current for voltages up to 220, pressures beyond this being unsafe.

Control of the valves may be had from any number of local or remote points and the control switches are fitted with indicating devices showing the position of the valve. The Dean system may be applied to any existing valves either of the O. S. & Y. or I. S. type, without shutting down the line. The valve may be operated by hand if the current fails.